

MRI T1 relaxation times for evaluating neoadjuvant treatment of rectal cancer

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Conflicts of interest

- Nothing to declare.

Background

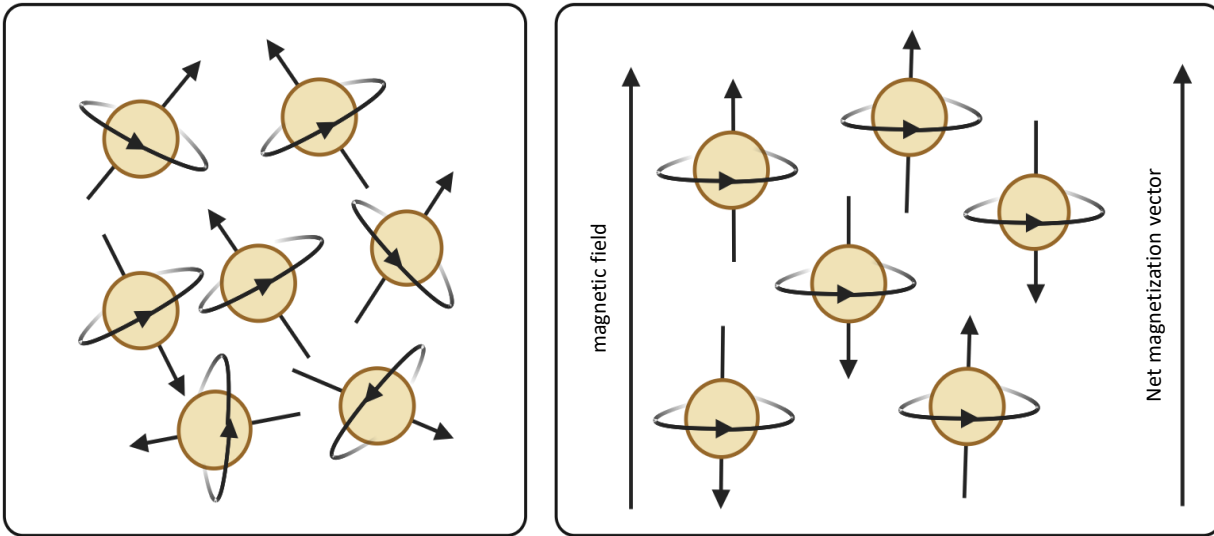
- Organ preserving strategies for rectal cancer patients.
- Increasing demand for radiologists.
- DWI has known pitfalls.



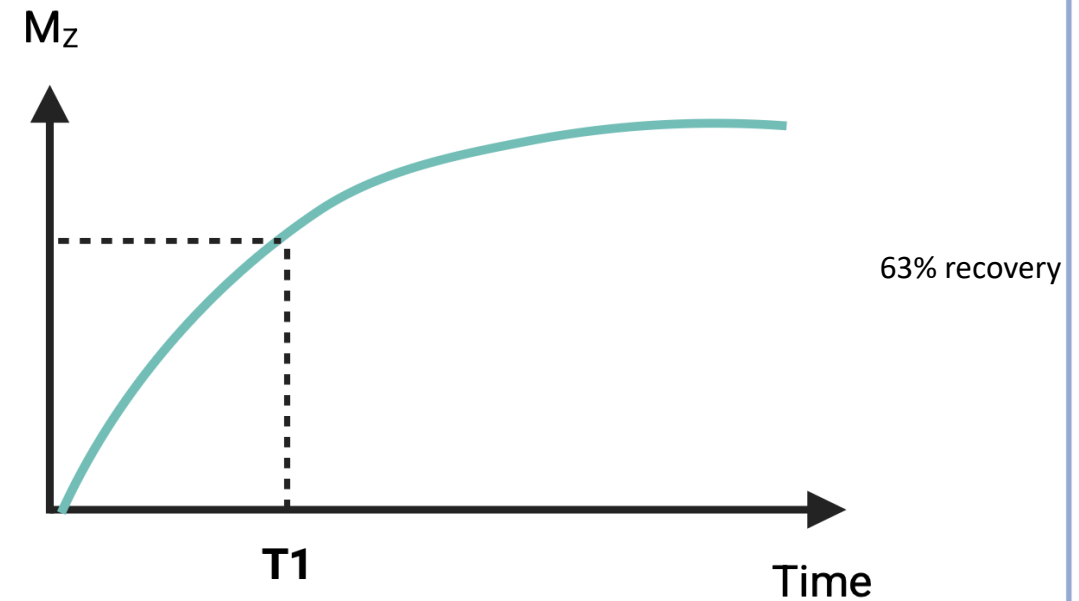
Background

T1 relaxation time

Protons of hydrogen nuclei



T1 relaxation time



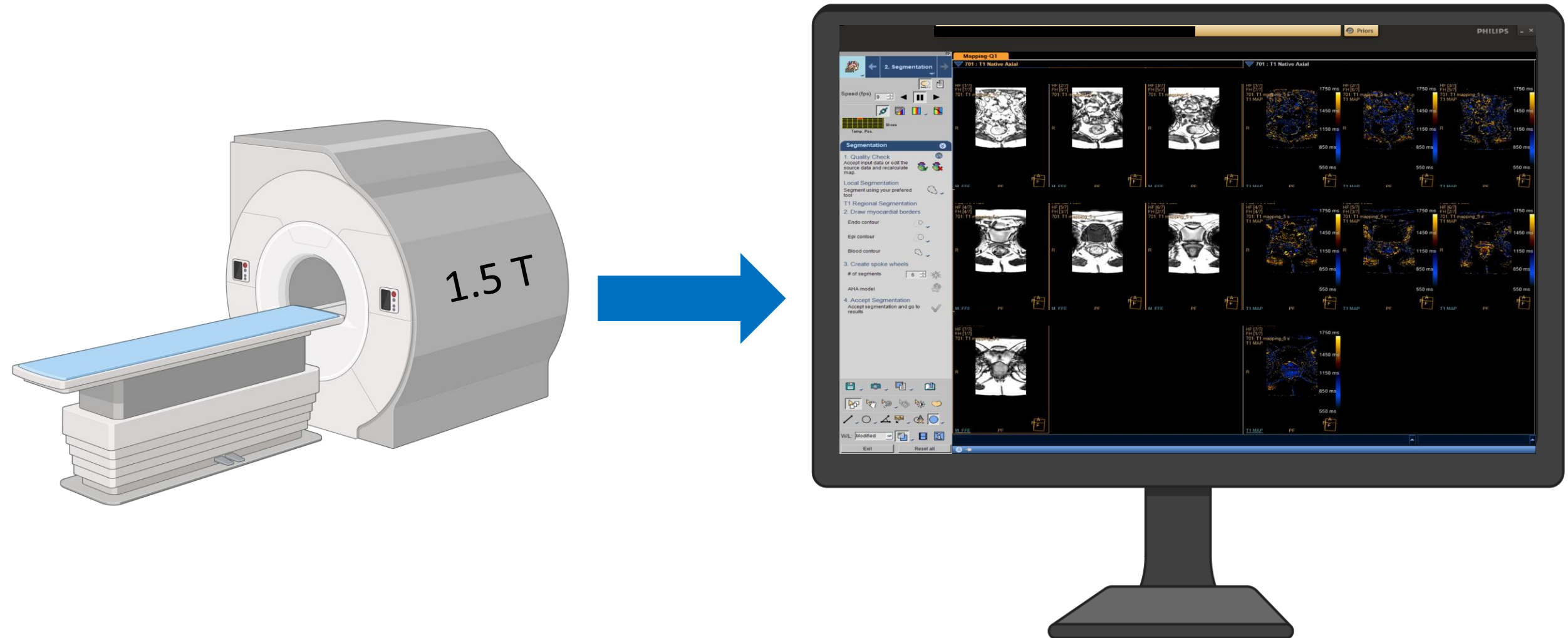
Background

Aim

- Investigate the diagnostic performance of T1 relaxation time for determining complete response in neoadjuvant treated rectal cancer.
- Investigate a correlation between T1 relaxation time and tumour volume and diffusion restrictive properties (ADC value).



Materials and methods

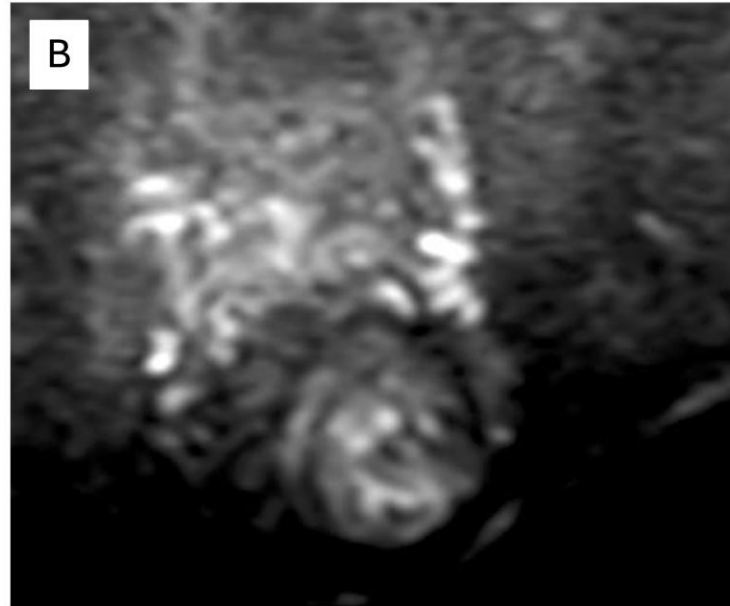


Materials and methods 2

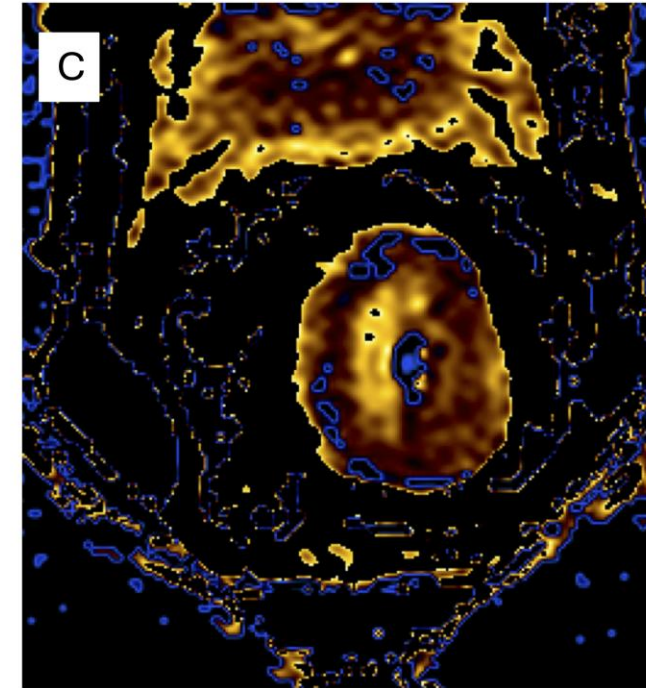
cT3dN1 mrEMVI+
T1RT: 1498 ms



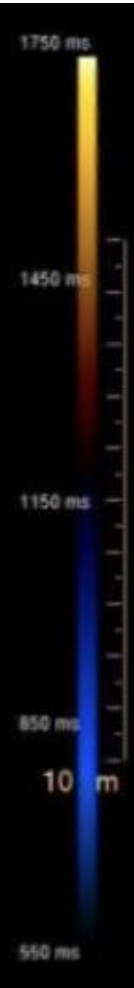
T2-weighted



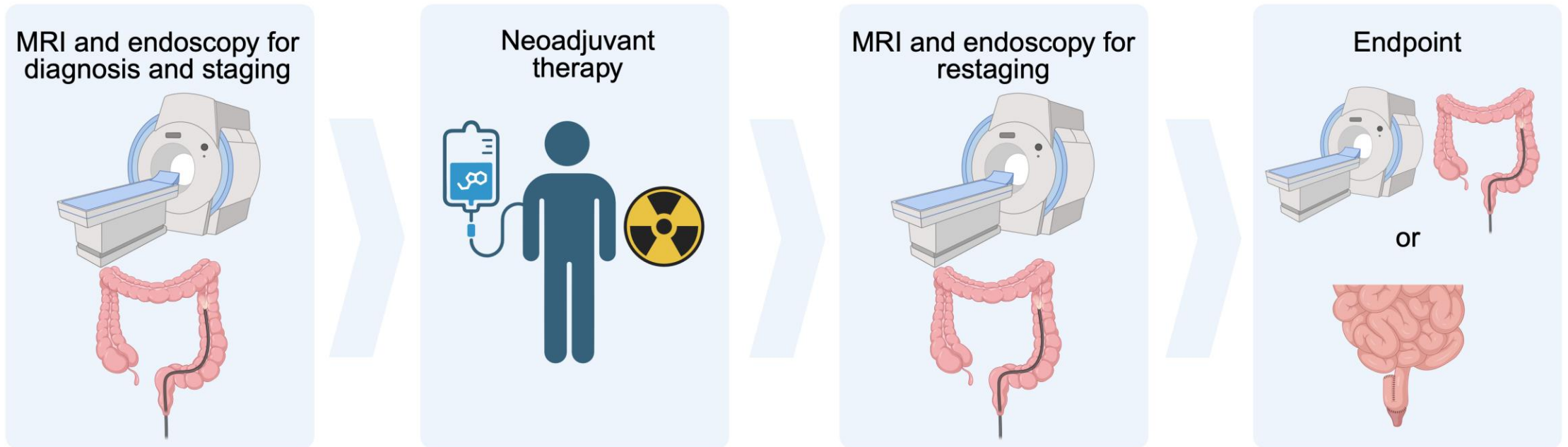
DWI
Diffusion weighted image
b800



T1 map



Materials and methods 4



Materials and methods - statistics

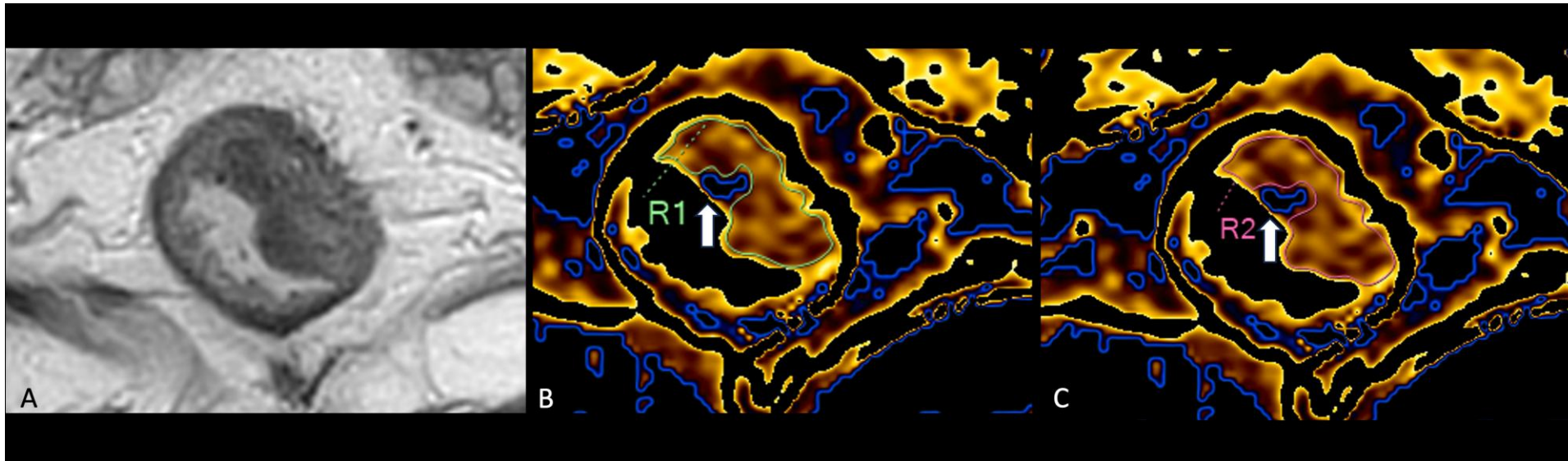
- Youden's Index and ROC analysis
- T test
- Pearson's Correlation Coefficient
- Cross validation and boot sampling
- Box plots and scatter plots

Inter- and intraobserver analysis

In press, Acta Radiologica
doi: 10.1177/02841851261453893

2 observers, 41 T1 maps, including WW patients.

Interobserver	ICC	95%CI	Intraobserver	ICC	95%CI
1st read	0.93	0.85 - 0.97	Reader 1	0.94	0.88 - 0.97
2nd read	0.91	0.83 - 0.95	Reader 2	0.90	0.81 - 0.95

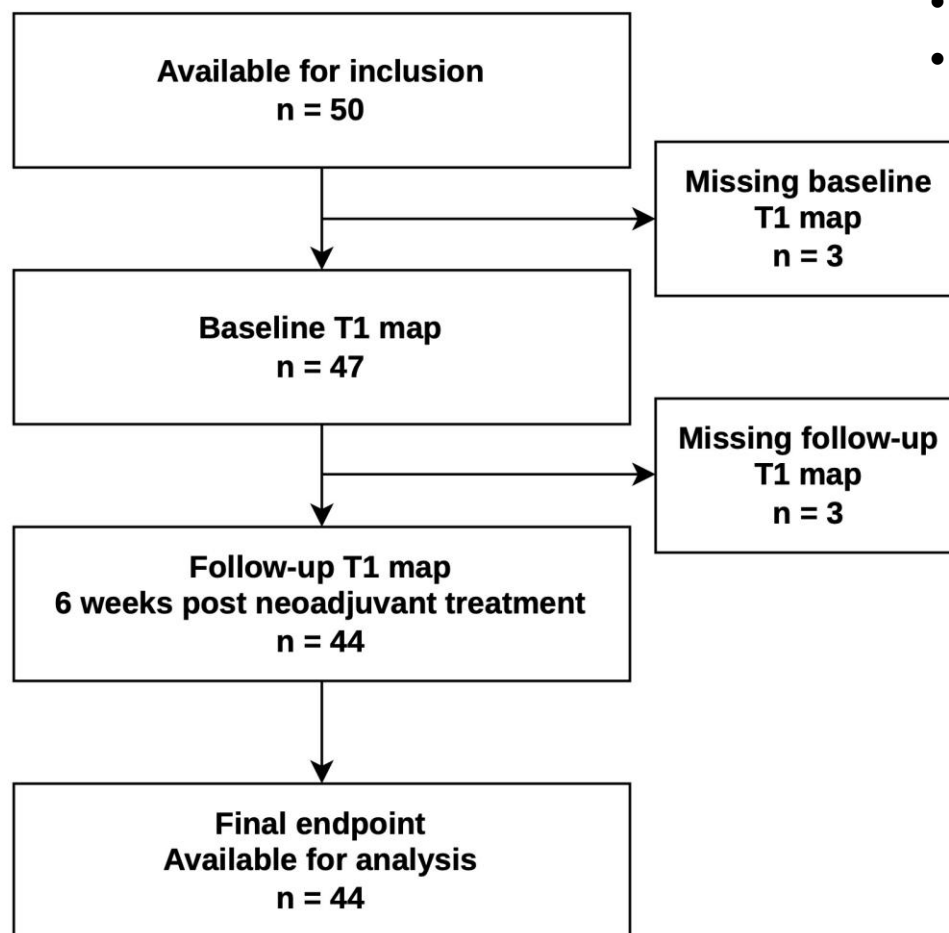


Participants

Single center.
Prospective inclusion.

Inclusion criteria

- >18 years of age
- Confirmed rectal adenocarcinoma
- Intended neoadjuvant treatment



Results

May 2023 - October 2025

Table 1 Patient characteristics	Complete response	Incomplete response
	(n = 18)	(n = 26)
Male/female, sex n	11/7	16/10
Age (mean)	64.3 (+- 12.3)	62.8 (+-14.0)

Results 2

Table 1 Patient characteristics		Complete response (n = 18)	Incomplete response (n = 26)
cT-category			
	cT1-2	11	2
	cT3ab	1	4
	cT3cd	5	11
	cT4ab	1	9
cN-stage			
	cN0	5	2
	cN1	5	7
	cN2	8	17
	mrEMVI+	3	21
	MRF+	5	21

Results 3

Table 1 Patient characteristics		Complete response (n = 18)	Incomplete response (n = 26)
Treatment			
Chemotherapy		0	5
Radiotherapy		1	3
Chemoradiotherapy		17	17
Immunotherapy		0	1
Radiation dose: 25 / 50.4 / 62 Gy		1 / 14 / 3	2 / 16 / 2
Surgery n		1	18

Results 4

Response

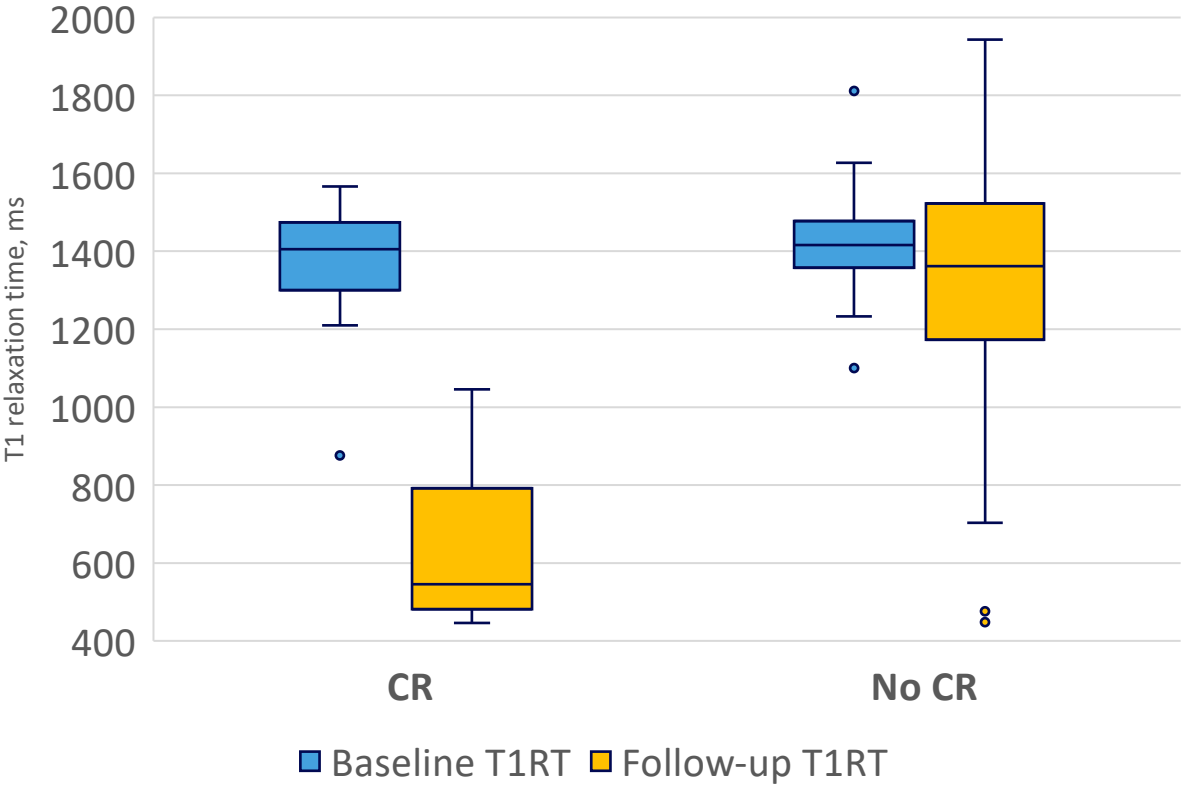


Table 3 Paper III results

	Baseline		Six weeks follow-up	
	T1RT [ms]	95% CI	T1RT	95% CI
All patients, n = 44	1399	1356 to 1442	1027	895 to 1160
CR, n = 18	1370	1294 to 1446	632	542 to 723
No CR, n = 26	1419	1365 to 1473	1301	1165 to 1437
T1RT: T1 relaxation time, CI: Confidence Intervals				

Studie III – Resultater

Respos

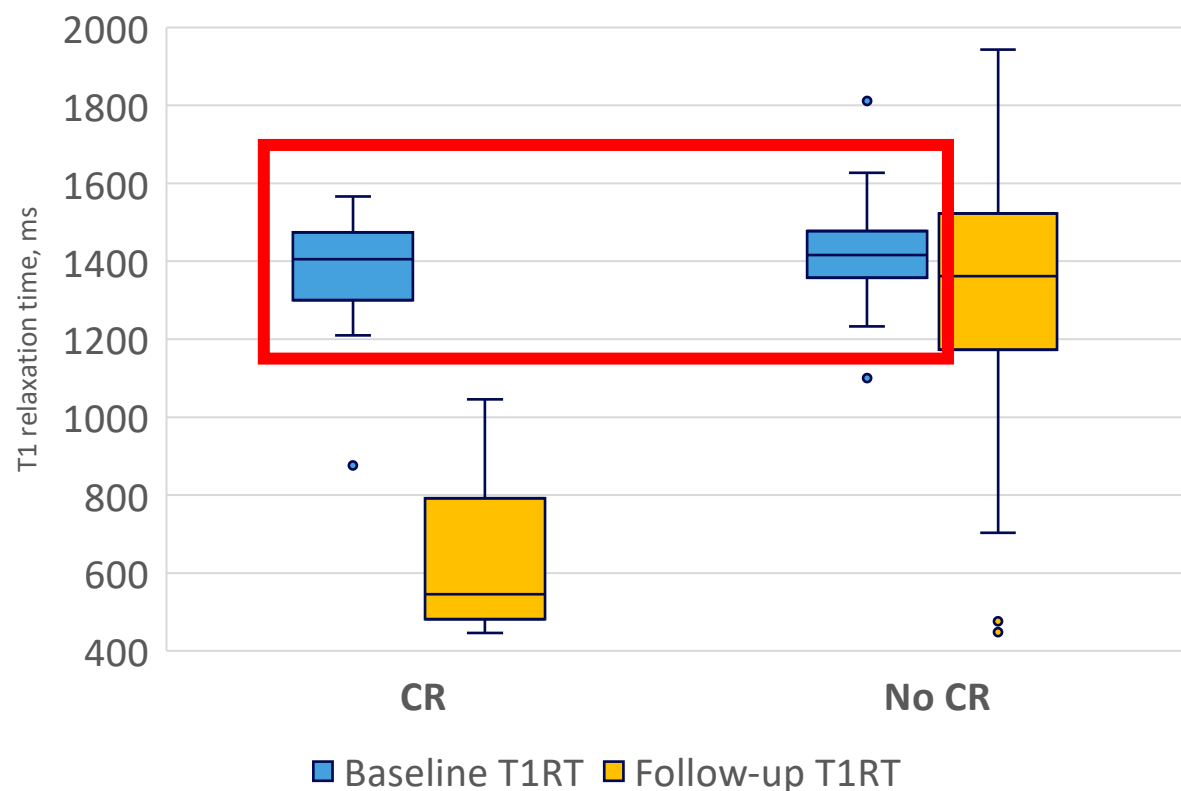


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Studie III – Resultater

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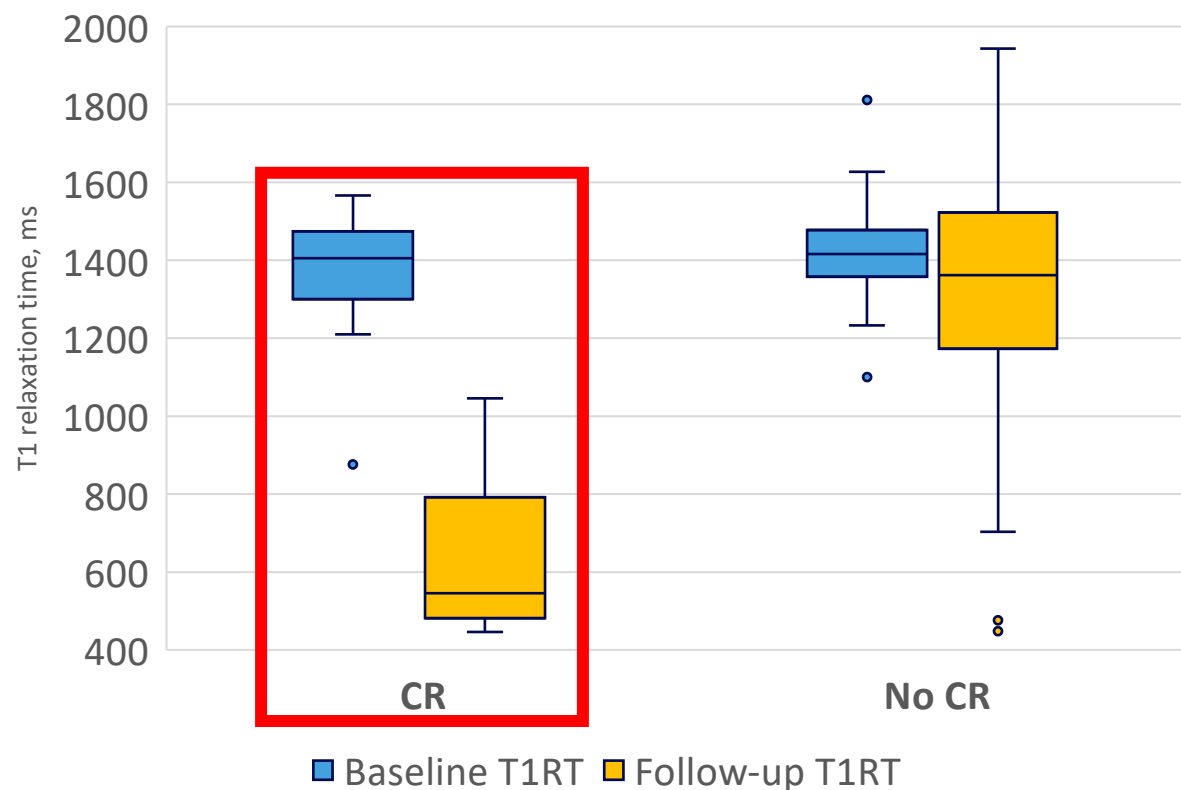


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Studie III – Resultater

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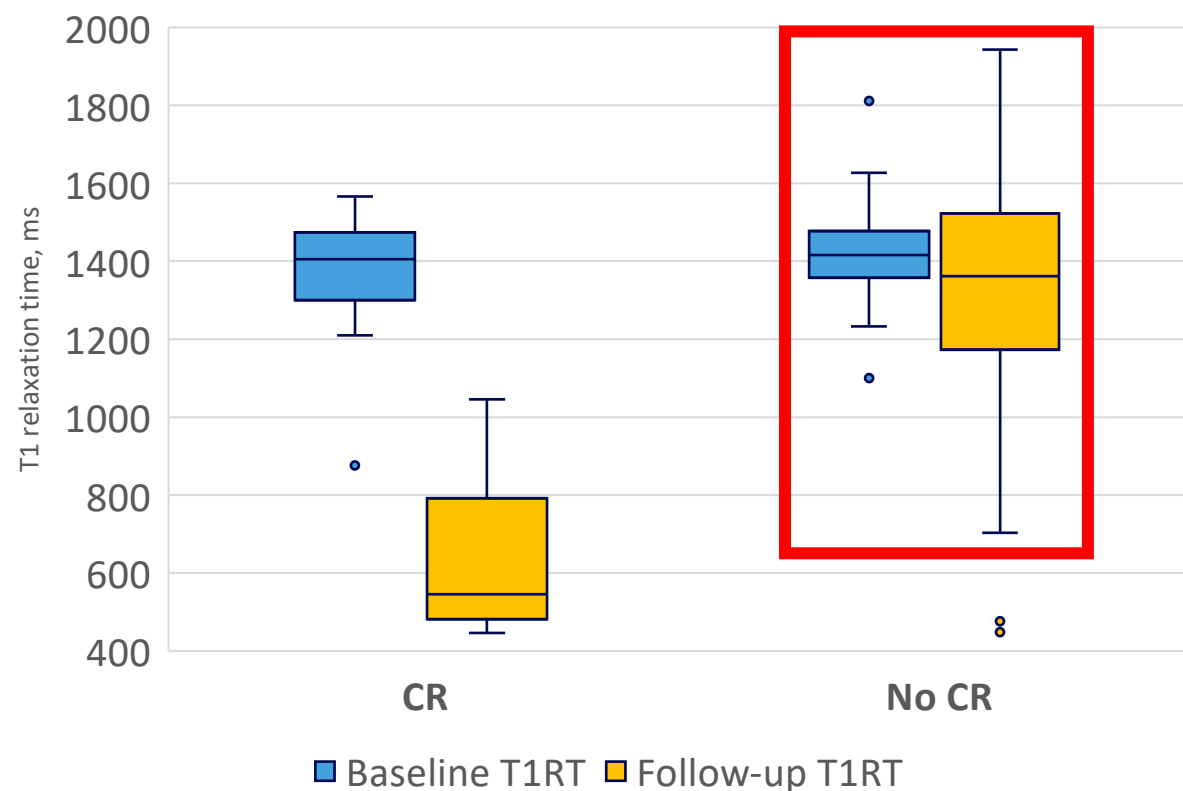


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Studie III – Resultater

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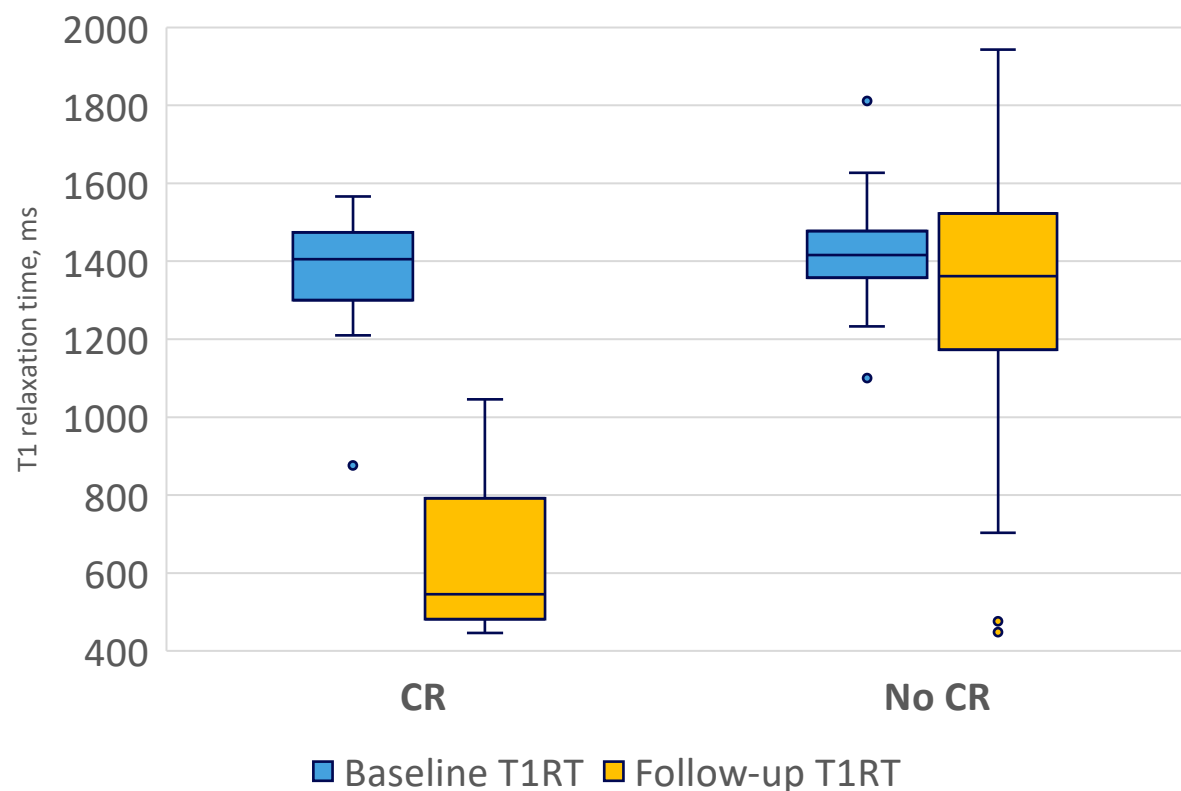


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Results

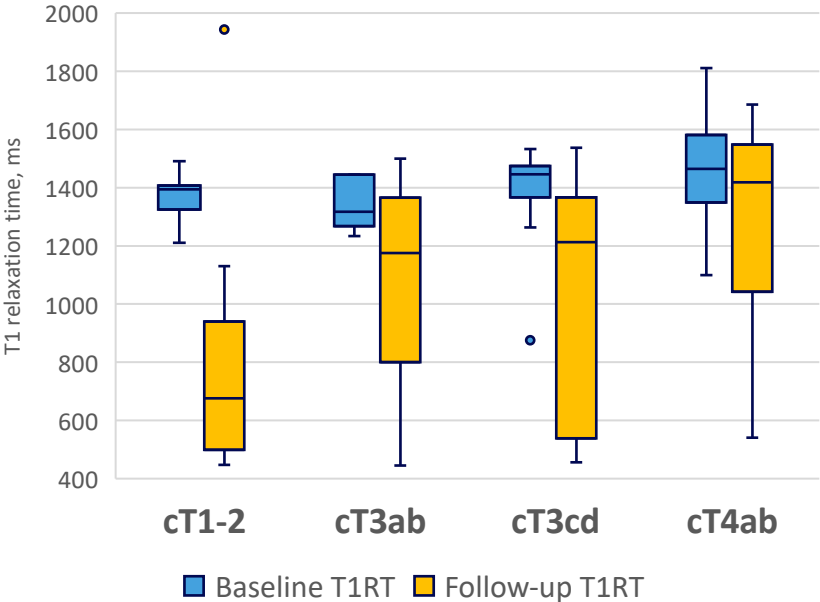
Youden's Index (optimised threshold): 1088 ms

- Sensitivity: 88.5% (95% CI 69.8 – 97.6).
- Specificity: 100% (95% CI 81.5 – 100).
- AUC: 0.94 (95% CI: 0.82 – 1.00).

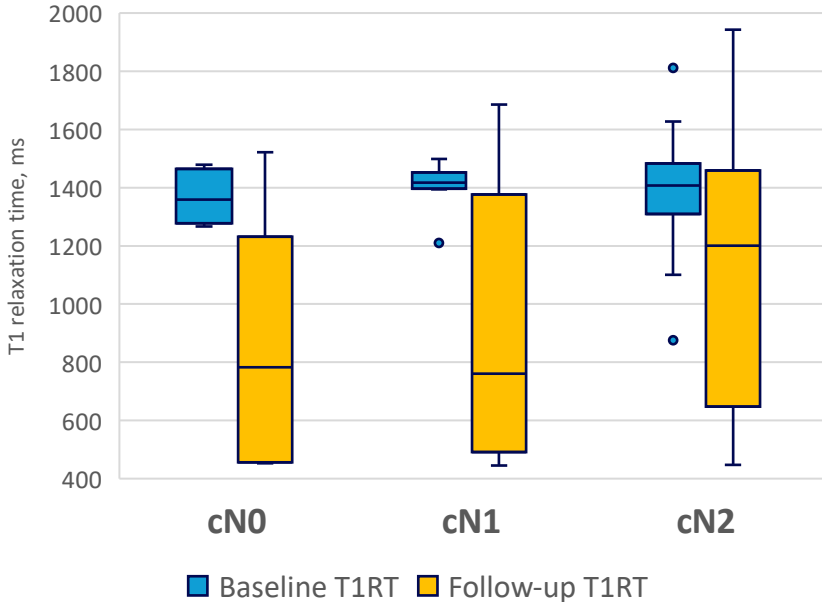
- Positive predictive value for CR: 100% (95% CI 85.2 – 100).
- Negative predictive value for CR: 85.7% (95% CI 63.7 – 97.0).

Studie III – Resultater

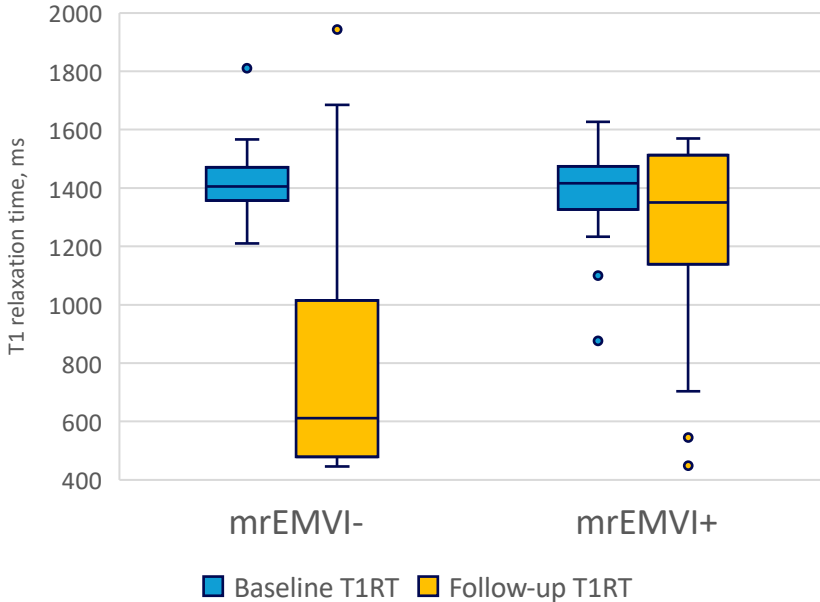
cT-category



cN-stage



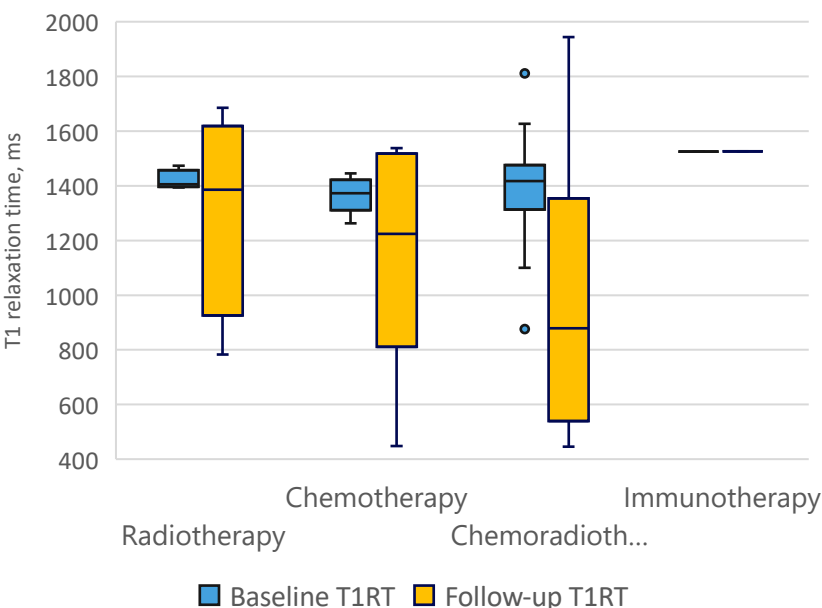
mrEMVI-status



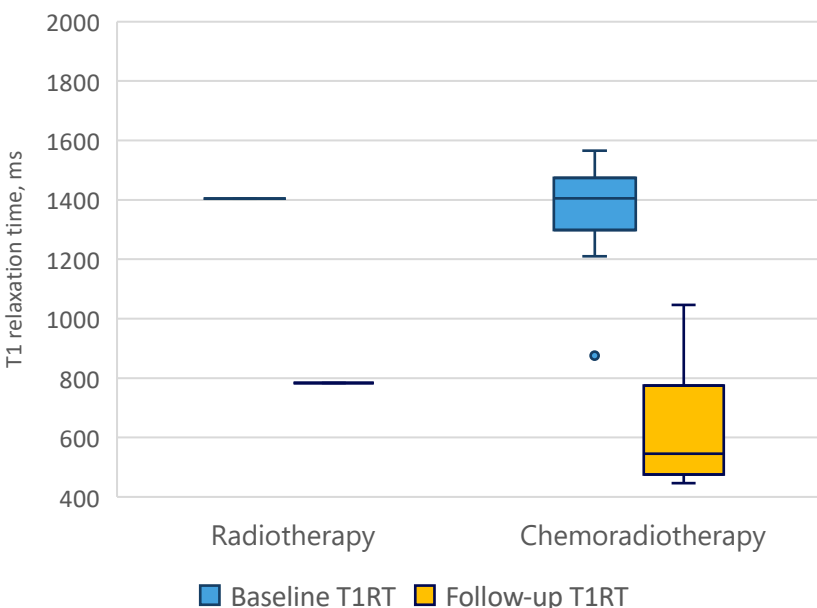
Studie III – Resultater

Behandlingsstrategier

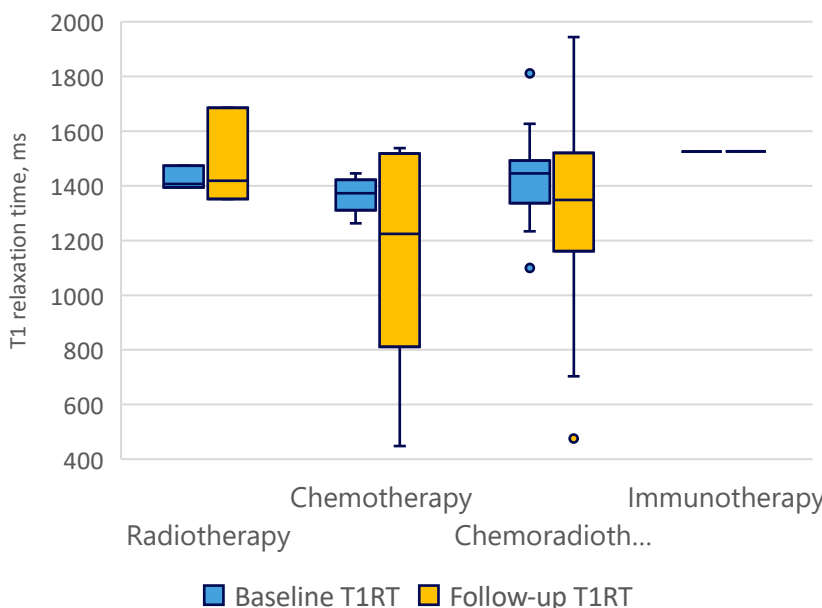
Alle



Komplet respons-gruppe

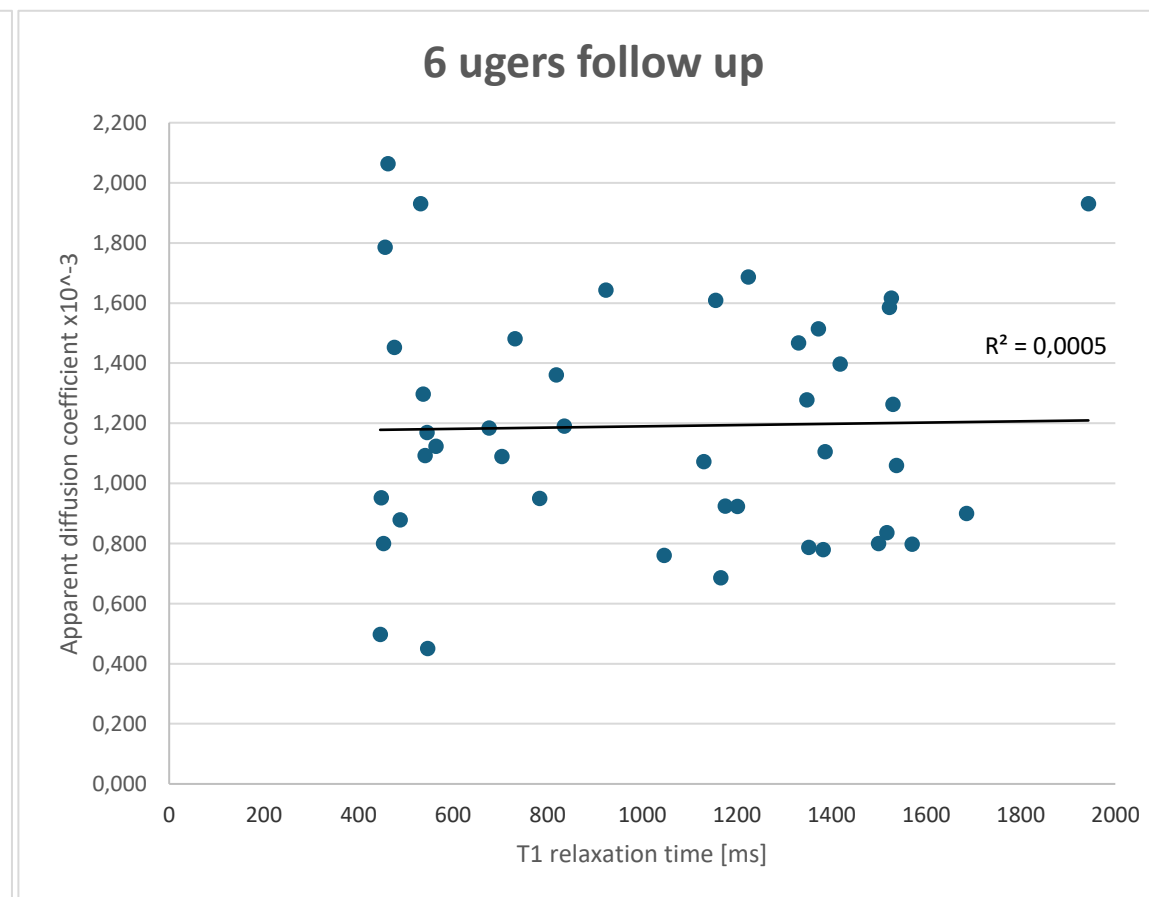
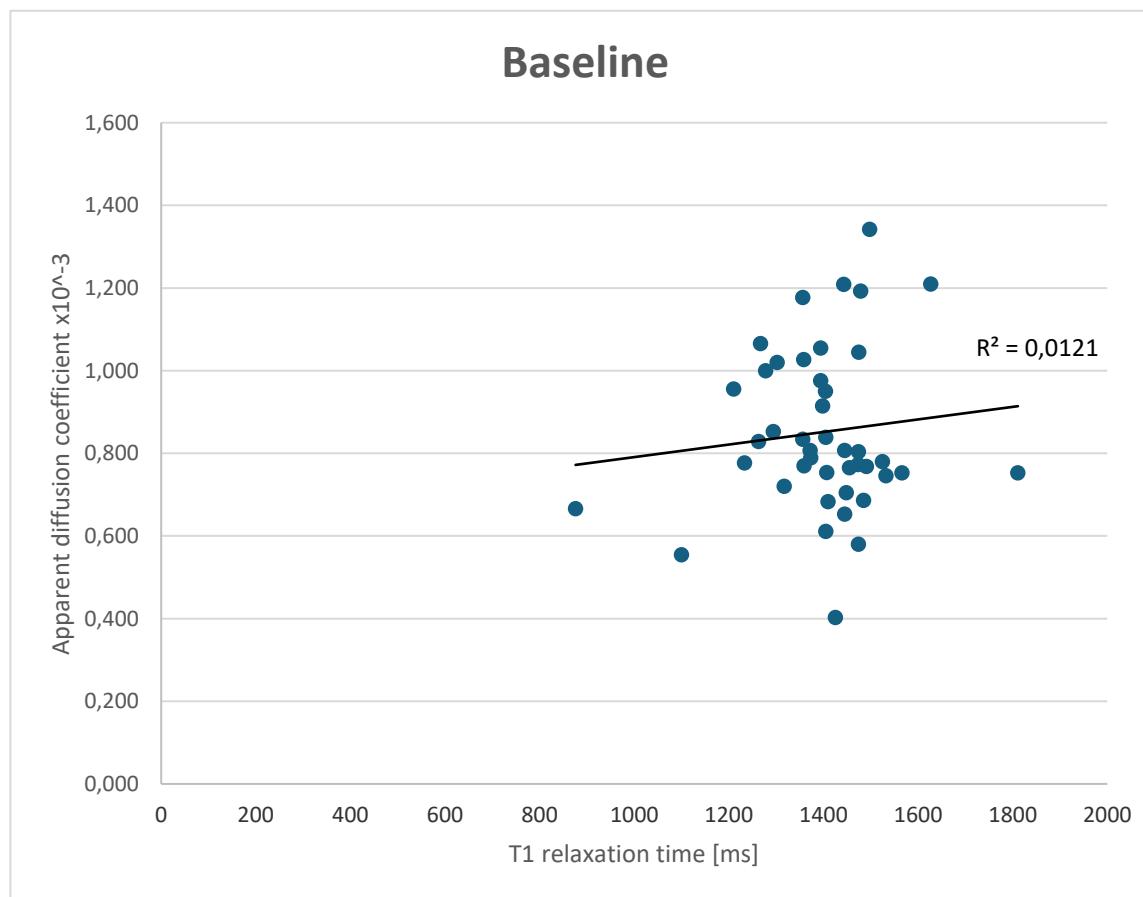


Inkomplet respons-gruppe



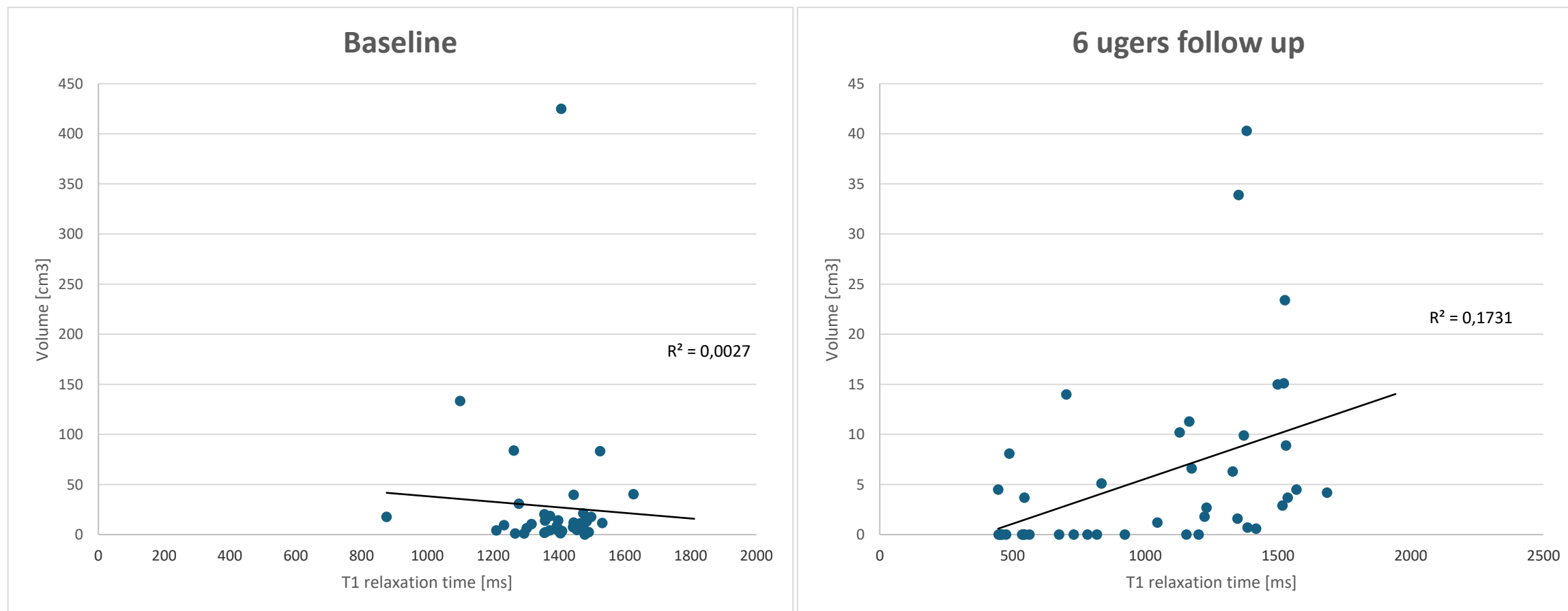
Studie III – Resultater

Apparent Diffusion Coefficient og T1 relaksationstid



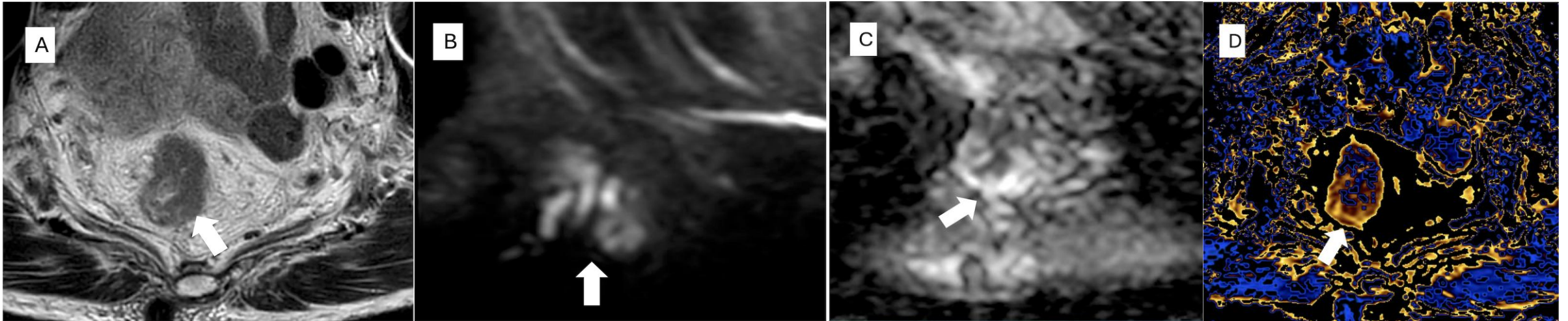
Studie III – Resultater

Tumorvolumen og T1 relaksationstid



Discussion

- Comparing with DWI



Discussion

- mrEMVI+ and T1 relaxation time.
- No correlation with ADC or the tumour volume.
- No predictive value at baseline.
- 6 weeks follow up and evaluation windows

Conclusion

MRI T1RT had a high diagnostic performance for identification of neoadjuvant therapy 6 weeks after treatment.

No correlation with tumour volume or ADC.

T1RT can be a complimentary imaging biomarker for evaluation of treatment effect and for selection of candidates for organ preserving strategies.